1513018013

GAS COMBUSTION RETORTING
DETAILED RUN SUMMARY SHEET

Date 6-24-67

Purpose: To determine quality and yield with 1/4 - 2 1/2 inch shale with hot air (without dilution gas)

GENERAL	
	R-1
Run No.	C1047-1
Length, hours	12
Retort Type Number	RC-VII
Oil Recovery System Number	O-2
Total Raw Shale Charged, ~~lbs.~~ Tons	99.58
Bed Height above Dist., ft	9 1/2
Type Air Dist.	ADXI
Bed Below Air Dist., ft	6
RATES AND QUANTITIES	
Raw Shale, lbs/(hr)(ft^2)	301
Spent Shale, % of RS	82.4
Liquid Product, lbs/hr	1803.8
Oil Collected, gal/ton RS	25.3
Air, SCF/ton RS (dry)	4340
Total Recycle*, SCF/ton RS(wet)	13900
Dilution, SCF/ton RS (wet)	—
Calc.Vent Gas SCF/ton RS(dry)	5780
Gas Losses, SCF/ton RS(wet)	677
Propane, SCF/ton RS	17.9
TEMPERATURES AND HEAT BALANCE	
Retort Offgas, °F	138
Spent Shale, F	475
Raw Shale, °F	94
Recycle Gas Inlet, °F	265
Dilution Gas Inlet, °F	—
Air Inlet, °F	147
Retort Air Inlet, F	147
Heat of Comb. MBtu/ton RS	417
Heat Lost, MBtu/ton RS	38
RAW SHALE PROPERTIES	
Fischer Assay, gal/ton RS	27.4
Oil, Wt %	10.5
Water, Wt %	0.8
Gas, Wt %	2.5
Mineral CO_2, Wt %	18.1
Ash, Wt %	66.8
Moisture, Wt % (Uncrushed)	1.0 Est.
Carbon (Total), Wt %	17.5
Hydrogen (Total), Wt %	1.80
Nominal Size Range, inches	1/4"-2 1/2"
5 % passing thru	0.371
98 % passing thru	2.50
D_a	1.180
D_v	1.570
Line Burner °F	880

SPENT SHALE PROPERTIES	
Fischer Assay, Gal/ton	0.0
Mineral CO_2, Wt %	16.7
Ash, Wt %	81.1
Carbon (total), Wt %	7.37
Organic Carbon, Wt %	2.81
Hydrogen (total), Wt %	0.25
LIQUID PRODUCT PROPERTIES	
Oil, Wt %	97.2
Density, lb/gal	7.752
Gravity, API	20.5
Ash, Wt %	—
PRODUCT GAS PROPERTIES	
Water Vapor, lbs/MSCF(dry)	5.1
Oil, lbs/MSCF(dry)**	0.178
Analysis (dry)	
CO_2, Vol %	23.3
O_2, Vol %	0.0
N_2 + Argon, Vol %	59.4
CH_4, Vol %	2.5
CO, Vol %	4.0
H_2, Vol %	6.6
Other, Vol %	4.2
Gross Heating Value(calc),Btu/SCF	134.6
Carbon (Total), lbs/MSCF (dry)	12.9
Hydrogen (Total), lbs/MSCF (dry)	0.98
YIELDS AND BALANCES	
Oil Collected, Vol % RSFA	92.2
Oil in Gas**, Vol % RSFA	0.5
Oil in Spent Shale, Vol % RSFA	0.0
Total Oil Meas., Vol % RSFA	92.7
Carbonate Decomposition, %	24.0
Water Recovered, lb/ton RS	53.5
Ash Balance, % - As Measured	—
Ash Balance, % - Assumed	R.S. 100
Overall Balance, %	99.9
Carbon Balance, % - Organic	103.7
Carbon Balance, % - Total	103.6
Hydrogen Balance, % - Organic	97.5
Hydrogen Balance, % - Total	97.2
Water Balance, %	83.8
MISCELLANEOUS	
Avg. Retort ΔP, in H_2O/ft	0.34
ΔP Above Air Dist., in H_2O/ft	0.33
NaCl Soln., Wt %	—
NaCl Rate, gal/ton RS	—

Comments: Gas leaks formed on west of retort above air distributor inlet plate. RS supply off for approximately 2 1/2 hours.

*Measured Recycle + Dilution Gas

** Oil Mist + Condensibles to 82 °F

*** Rates are for moisture-free raw shale. All shale analyses are on a moisture-free basis.

Signed Earl E. [signature]   DATE July 17 1967

OSRC-10

//A100
2080, C1047-1 R-1 6-24-67

A. YIELDS

FAY	9.221E 01	DRYGAS	5.783E 03	MISTFA	4.836E-01
H2	3.816E 02	OTHER	2.429E 02	UNRETO	0.0
CH4	1.446E 02	O2	0.0	SSY	8.237E 01
CO	2.313E 02	CO2DEC	2.400E 01	MH2O	5.346E 01
CO2	1.347E 03	OILCOL	2.526E 01		

B. METERED GAS RATES

RECG	1.389E 04	DIL	0.0	WVENTG	5.731E 03
AIR	4.341E 03	TRECG	1.389E 04	TGF	0.0

C. MOL WT & HEATING VALUE OF VENT GAS

MWWG	2.922E 01	HVGT	7.783E 02	MWDG	3.043E 01
GBTU	1.346E 02				

D. COMBUSTION PRODUCTS

CO2C	5.265E 02	COC	2.096E 02	H2OC	2.695E 01
CHR	7.714E 00	COMBCP	9.229E 00		

E. MATERIAL IN

ORGCIN	2.529E 02	RSR	3.006E 02	ORH2IN	3.459E 01
MATIN	2.355E 03				

F. MATERIAL OUT

ORGCVG	5.118E 01	COKEC	4.631E 01	UNRETH	0.0
ORGCOL	1.647E 02	ORH2VG	8.802E 00	COKEH	3.196E 00
UNRETC	0.0	ORH2OL	2.174E 01	ORCOLP	6.514E 01
ORCVGP	2.024E 01	ORCSSP	1.831E 01	HCCVGP	1.101E 01

G. MATERIAL BALANCES

OVALL	9.993E 01	ORH2	9.753E 01	O2BAL	9.793E 01
ASH	0.0	TC	1.036E 02	WATER	8.384E 01
ORGC	1.037E 02	TH2	9.720E 01	GASL	6.771E 02
ASHB	-1.000E 00				

H. HEAT IN

QCOMB	4.169E 05	QH2OC	1.063E 04	QAIR	4.244E 03
QPROP	4.529E 01	QOILC	1.371E 04	QRCYL	5.141E 04
QSUMIN	4.969E 05				

I. HEAT OUT

QMCO2D	1.408E 05	QKEROD	1.040E 05	QH2OV	4.024E 04
QLIQO	3.206E 03	QOFGAS	1.888E 04	QSS	1.459E 05
QGASL	5.782E 03	LBLOSS	0.0	HETLOS	3.819E 04
QSUMOT	4.969E 05				

J. MISCELLANEOUS

ORCSS	2.811E 00	VPOIL	1.776E-01	TGL	2.949E 03
VPM	5.144E 00	WCG	9.761E 00	PROP	1.790E 01

END MESSAGE

END OUTPUT

HEAT AND MATERIAL BALANCE FOR PILOT RETORTS – DATA SHEET

LINE #	PROGRAM ID	USER IDENTIFICATION					
0	2080,	C1047-1 R-1 6/24/67					
	WRS	OLRS	TRS	B	MRS		RAW SHALE
1	0.8	10.5	94	-1	16597.4		
	FA	GRS	CORS	XA			
2	27.4	2.5	18.1	55.22			
	ASRS	CRS	HRS	BP	TOG		
3	66.8	17.5	1.8	24.38	138		
	CRA	MFA	TA	PA	WA	LBHL	AIR
4	601.1	1.0	147	121	0.14	0	
	CRRG	MFRG	TRG	PRG	CRTG	MFTG	RECYCLE A TOTAL GAS
5	1929.4	1.0	265	81	0.0	0.0	
	CRDG	MFDG	TDG	PDG			DILUTION G
6	0.0	0.0	0	0			
	P	TP	PP	W	N		PROPANE A NUCLEATIN AGENT
7	2.85	0.4	128.4	167.7	0.0		
	WSS	OLSS	GSS	SS			SPENT SHALE
8	0.5	0.0	0.0	0.0			
	COSS	ASSS	CSS	HSS	TSS		
9	16.7	81.1	7.37	0.25	475		
	OILLP	COL	HOL	DOL	WLP		LIQUID PRODUCT
10	1625.3	89.1	11.1	7.752	128.5		
	CRVG	MFVG	TVG	WG	OILM	M	VENT GAS
11	849.9	1.0	263	0.0	0.0	0	
	CG	H	COOG	OG	NG		
12	12.8	0	23.3	0.0	59.9		
	MEG	COG	HHG	OTG	HG		
13	2.5	4.0	6.6	4.2	0.98		
	CRVP	VPMF	TVP	PVP			VENT PURGE
14	2.8	2.16	155	49			
	TVPC	VPOIL	VPW	GL			
15	82	58.3	2.2	91.4			

OPTIONS:

1. *B Enter "1" to Calculate with Spent Shale Rate and Ash Analyses,*
   Or "0" to Calculate with Measured Rates,
   Or "-1" to Calculate with Raw Shale Rate and Ash Analyses.
2. *M Enter "1" to Calculate with Measured Moisture and Mist,*
   Or "0" to Calculate from Vent Purge Data.
3. *H Enter "1" to Calculate using Retort #2,*
   Or "0" to Calculate using Retort #3.

MESH		
8	130.8	25.1
14	116.7	22.4
28	67.4	12.9
35	25.7	4.9
48	19.2	3.7
65	17.5	3.3
100	18.3	3.5
150	18.6	3.6
PAN	107.7	20.6
TOTAL	521.9	100%

LABORATORY ANALYSIS SHEET

ANVIL POINTS OIL SHALE RESEARCH CENTER

Date Sampled 6-24-67 Run No. C 1047-1

Sample Time: RS 1815 ; SS 2315

FISCHER ASSAY

(X) RAW SHALE	(+) SPENT SHALE	
27.2	6.0	Gal/Ton
.914	.	S.G., g/ml
10.4	0.0	Oil, wt %
1.6	0.5	Water, wt %
85.5	99.5	Sp. Shale, wt %
2.5	0.0	Gas & Loss, wt %
slight	none	COKING TENDENCY

( ) RETORT SHALE MOISTURE

0.79 + wt %

(X) RAW SHALE FISCHER ASSAY MOISTURE

0.82 wt %

+C

	(X) RAW SHALE	(+) SPENT SHALE	
MINERAL CO_2	18.0	16.7	wt %
ASH (SHALE)	66.6	81.1	wt %
MOISTURE	0.35	0.08	wt %
CARBON	17.4	7.37	wt %
HYDROGEN	1.79	0.25	wt %
BENZENE EXTRACTABLES	.	.	wt %

( ) SHALE RICHNESS DISTRIBUTION (See attached graph)

(X) SCREEN ANALYSIS (See back of this sheet)

All results are "as received" unless noted. "Moisture" designates the moisture content of the -48 mesh material used for "Ash", "Mineral CO_2", "Carbon", and "Hydrogen". The "FA Moisture" is for the sample used for the Fischer Assay.

COMMENTS

DATE COMPLETED JUN 27 1967 CHECKED BY

OSRC 12A

LABORATORY ANALYSIS SHEET

ANVIL POINTS OIL SHALE RESEARCH CENTER

Date Sampled 6-24-67 Run No. C 1047-1 (2100)

LIQUID PRODUCTS

	D3 PUMPOUT				T3 PUMPOUT	
	1	2	3	4	1	2
WATER, wt %	2.8	/	/	/		
GRAVITY, °API	20.5					
◯ OIL ASH, wt %						

◯ DISTILLATION (See attached sheet - OSRC-24)

VENT PURGE PRODUCT

OIL WT, g 699.4

WATER VOL, ml 14.0

GRAVITY OIL, °API 42.0

VENT GAS

⊗ MAJOR COMPONENTS

			◯ C_1 thru C_4, plus n-Pentane		
CO_2	23.3	vol %	CH_4	.	vol %
O_2	0.0	"	C_2H_4-C_2H_6	.	"
N_2	58.7	"	C_3H_8	.	"
CH_4	2.5	"	C_3H_6	.	"
CO	4.0	"	i C_4H_{10}	.	"
H_2	6.6	"	n C_4H_{10}	.	"
Ar	.7	"	$\emptyset C_3H_6$	.	"
Others	4.2	"	n C_5H_{12}	.	"

⊗ CARBON, 12.8 lbs/MSCFDG HYDROGEN, 0.98 lbs/MSCFDG

COMMENTS

JUN 26 1967

DATE COMPLETED CHECKED BY

SCREEN ANALYSIS DATA SHEET (TY-LAB)

RUN NO. C 1047 - 1 SAMPLE NO. _____ DATE 6 - 24 - 67

UNIT Rot. + 2 DESCRIPTION TY Lap

APPROX. SHALE SIZE ± - 2½ SHAKING TIME 10 min ANALYSIS BY Lowery Co. TH

TOTAL SAMPLE WT. GROSS 65.1 - TARE 6.0 = NET 59.1

SCREEN SIZE			WEIGHTS		
SCREENS REQD.	OPENING SIZE	MESH	GROSS LBS.	TARE LBS.	NET WT. RETAINED
	4.25				
	3.00				
	2.50		17.4	16.7	0.7
	2.00		36.5	20.3	16.2
	1.50		40.6	23.4	17.2
	1.05		32.6	23.5	9.1
	0.742		28.1	22.6	5.5
	0.525		24.7	20.5	4.2
	0.371		20.9	19.2	1.7
	0.263	3	20.0	18.4	1.6
	0.185	4	19.7	19.4	.3
	0.131	6	19.5	19.4	.1
	0.093	8	20.4	20.4	.0
	0.065	10	19.3	19.2	.1
	PAN		22.9	20.9	2.0
	TOTAL ON SCREENS AND PAN				59.2
	LOSS (BY DIFFERENCE)				+.1
	TOTAL SAMPLE WEIGHT				59.1

SCREEN SIZE	Di *	1/Di	% RETAINED	CUM. % RETAINED	% PASSING
4.25					
3.00	(3.125)	(0.3200)			
2.50	(2.625) 2.750	(0.3809) 0.3636	1.18		98.81
2.00	2.250	0.4444	27.53		71.28
1.50	1.750	0.5714	29.05		42.23
1.05	(1.087) 1.275	(0.9199) 0.7843	15.88		26.35
0.742	0.896	1.116	9.46		16.89
0.525	0.634	1.577	7.09		.980
0.371	0.448	2.232	7.87		6.93
0.263	0.317	3.154	2.70		4.23
0.185	0.224	4.464	0.51		3.72
0.131	0.158	6.329	0.17		3.55
0.093	0.112	8.928	0.00	96.44	3.55
0.065			0.17		3.38
PAN			3.38		0.00
LOSS			—	—	—
TOTAL			99.99	—	—
			—	—	—

* NUMBERS IN PARENTHESES SHOULD BE USED WHEN THESE SCREEN SIZES REPRESENT THE TOP OF THE SHALE SIZE RANGE.

$\sum_{+8m}^{m} Di$	1.51378	$\sum_{+8m}^{m} Xi$	
$1/\sum_{+8m}^{m} Di$	0.81750	$\sum_{+8m}^{m} Xi / Di$	
Da	1.17969	$\sum_{+8m}^{m} Xi\ Di$	
Dv	1.56966		

REMARKS: _____

OSRC-4